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(NASA-CR-167686) RESULTS OF THE AFRSI DETAILED-ENVIRONMENT TEST OF THE 0.035-SCALE SSV PRESSURE-LOADS MODEL 84-0 IN THE AMES 11X11 FT. TWT AND THE LEWIS 8X6 FT. AND 10X10 FT. SWT (CA-310A, B, C), (Chrysler

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SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

Data Management Services

HUNTSVILLE ELECTRONICS DIVISION CHRYSLER CORPORATION

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Volume 2 of 2

RESULTS OF THE AFRSI DETAILED-ENVIRONMENT TEST OF THE 0.035-SCALE SSV PRESSURE-LOADS MODEL 84-0 IN THE AMES 11x11 FT. TWT AND THE LEWIS 8x6 FT. AND 10x10 FT. SWT (OA-310A, B, C)

by

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Prepared under NASA Contract Number NAS9-16283

by

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for

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Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number:	ARC 587-1-11	LeRC 046	LeRC 074
Tunnel:	11x11-foot	8x6-foot	10x10-foot
NASA Series Number:	OA-310A	OA-310B	OA-310C
Model Number:	84-0	84-0	84-0
Test Dates:	8-8-83 through 8-18-83	11-7-83 through 11-15-83	9-12-83 through 9-22-83
Occupancy Hours:	144	56	96

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ABSTRACT

Detailed orbiter aerodynamic and aeroacoustic pressure data were obtained in a three-part experimental investigation (OA-310A, B and C) which was conducted during the period from August to November, 1983. Test OA-310A, B and C was conducted in three NASA facilities: OA-310A in the Ames 11x11-foot Transonic Wind Tunnel; OA-310B in the Lewis 8x6-foot Supersonic Wind Tunnel; and OA-310C in the Lewis 10x10-foot Supersonic Wind Tunnel. Test data were obtained to support analysis of the Space Transportation System (STS) -6 Advanced Flexible Reusable Surface Insulation (AFRSI) anomaly using the 0.035-scale Space Shuttle vehicle pressure-loads Model 84-O.

During Test OA-310A, B and C, data were obtained for detailed orbiter aerodynamic and aeroacoustic environments in the areas of the orbiter where AFRSI is to be applied to OV-099 and OV-103. Emphasis was placed on acquiring detailed aeroacoustic data and time-averaged pressure distributions on five affected areas: (1) canopy; (2) side of fuselage; (3) upper surface of wing; (4) OMS pods; and (5) vertical tail. Data were obtained at nominal ascent and entry atmospheric flight trajectory conditions between M=0.6 through M=3.5.

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C	C_p VS x/c_W

INTRODUCTION

Advanced Flexible Reusable Surface Insulation (AFRSI) is presently being used as a replacement for most of the Low-Temperature Reusable Surface Insulation (LRSI) tiles on the Space Shuttle Orbiter Vehicle. The AFRSI is a quilted blanket consisting of silica fiber felt insulation material with a quartz fabric OML cover and a glass fabric IML lining. The quilting is done with quartz thread stitched through the three layers of material. The blanket IML is bonded to the skin of the vehicle while the OML face is exposed to the high pressure gradients, the fluctuating acoustic pressures, and the wind shear stresses attendant during entry into the atmosphere. The blankets are very flexible and susceptible to damage due to the hardness and brittleness of the individual fibrous elements.

The purpose of Test OA-310A, B, and C was to obtain data to support analysis of the STS-6 AFRSI anomaly using the 0.035-scale Space Shuttle Vehicle pressure-loads Model 84-O. Data were obtained for detailed orbiter aerodynamic and aero-acoustic environments in the areas of the orbiter where AFRSI is to be applied to OV-099 and OV-103. Emphasis was placed on acquiring detailed aeroacoustic data and time-averaged pressure distributions on five affected areas:
(1) canopy; (2) side of fuselage; (3) upper surface of wing; (4) OMS pods; and (5) vertical tail.

Data were obtained at nominal ascent and entry atmospheric flight trajectory conditions between M=0.6 through M=3.5. Also, model angles of attack, sideslip angles, rudder, speedbrake, and elevon deflections were varied. No internal balance was used during Test OA-310A, B, and C; however, the sting was gaged for deflection data during Test OA-310A.

INTRODUCTION (Concluded)

Test OA-310A was conducted in the NASA/Ames Research Center (ARC) 11x11-foot Transonic Wind Tunnel. Test OA-310B was conducted in the NASA/Lewis Research Center (LeRC) 8x6-foot Supersonic Wind Tunnel and Test OA-310C was conducted in the LeRC 10x10-foot Supersonic Wind Tunnel.

This report contains information on the conduct of Test OA-310A, B, and C and descriptions of the test facilities and instrumentation. Photographs of the 0.035-scale Space Shuttle Vehicle pressure-loads Model 84-O are included. In addition, static pressure data are tabulated and sample plotted data are presented.

NOMENCLATURE

Symbol	Mnemonic	Definition
C_p	CP	Pressure Coefficient
dB		Volume of Sound (decibel)
°F		Degrees Fahrenheit
ft		Feet
in.	INCHES	Inches
M	MACH	Freestream Mach Number
N	ETA	Percent Span
P	P	Freestream static pressure, psia
PHI	PHI	Angular location measured clockwise from bottom of fuselage, degrees
P_L		Local static pressure, psia
P_{RMS}		Root Mean Square (RMS) pressure in psia
psf		Pounds per square foot
psia		Absolute pressure in pounds per square inch
P_t	PT	Freestream total pressure, psf
Q, q	Q(PSF)	Freestream dynamic pressure, psf
°R		Degrees Rankine
	RN/L	Unit Reynolds number, million per ft.
sq ft	SQ.FT.	Square feet
X		Model-scale station
X/C		Percent chord (local)
X/C_V	X/CV	Chordwise location on vertical tail, fraction of local chord
X/C_W	X/CW	Chordwise location on wing surface, fraction of local chord
X/ℓ_B	X/LB	Longitudinal location of orbiter body surface, fraction of body length

Symbol	Mnemonic	Definition
XO		Full-scale station
Y		Model-scale buttplane
YO		Full-scale buttplane
Z		Model-scale waterplane
ZO		Full-scale waterplane
α	ALPHA	Model angle of attack, degrees
β	BETA	Model sideslip angle, degrees
δ_{BF}	BDFLAP	Model body flap deflection angle, degrees
δ_e	ELEVON	Model elevon deflection angle, degrees
δ_{e_I}	IB-ELV	Model inboard elevon deflection angle, degrees
δ_{e_O}	OB-ELV	Model outboard elevon deflection angle, degrees
δ_R	RUDDER	Model rudder deflection angle, degrees
δ_{SB}	SPDBRK	Model speed brake deflection angle, degrees
%		Percent
	SREF	Wing reference area, ft^2
	LREF	Reference length, inches
	BREF	Wing reference span, inches
	XMRP, YMRP, ZMRP	Location of the moment reference point in the Orbiter coordinate system, inches

NOMENCLATURE (Concluded)

Other Symbology Includes:

Symbol	Definition
AFRSI	Advanced Flexible Reusable Surface Insulation
ARC	Ames Research Center
ESP	Electro Scan Pressure
IML	Inner Mold Line
KULI	Kulite
LeRC	Lewis Research Center
LRSI	Low-Temperature Reusable Surface Insulation
NA	Not Applicable
NASA	National Aeronautics and Space Administration
No., NUMB, #	Number
OML	Outer Mold Line
OMS	Orbiter Maneuvering System
ORIF	Orifice
OV	Orbiter Vehicle
SSV	Space Shuttle Vehicle
STA	Station
STS	Space Transportation System

REMARKS

Prior to run 4 of Test OA-310A, static pressure orifices numbered 345 and 369 were determined to be plugged. It should also be noted that prior to run 36, static pressure orifices numbered 119, 120, 142, 143, 144, 170, 171, 172, 221, 222, 240, 345, 488, and 512 were deleted from the data printout because they were not producing good data.

Kulites numbered K14, K24, K54, K65, K98, K103, K104, K105, K106, and K108 did not produce usable data during Test OA-310A. No Kulite data were obtained during run 6.

During Test OA-310B, not all test objectives were met. Airloads and aero-noise data from Mach numbers 1.4 through 2.0 were expected for this test. However, data were acquired for only Mach 1.4 and 1.6. Due to a malfunction of the Lewis 8x6-ft tunnel's number 2 drive motor, no data were obtained at Mach 1.8 or 2.0.

The following pressure taps were omitted from Model 84-O during Test OA-310B: 119, 120, 142, 143, 144, 170, 171, 172, 488, and 512. Tap No. 406 was plugged during Test OA-310B and Tap Nos. 426 and 513 were considered unusable. These three pressure taps were deleted from the data reduction output.

One hundred eight Kulites were mounted in the orbiter Model 84-O. However, only 100 Kulites were able to be recorded during Test OA-310B and C due to channel availability. During Test OA-310B, Kulites numbered K14, K19, K74, K80, K87, K92, K95, K102, K103, and K108 were not recorded. It should also be noted that Kulite K5 responded only intermittently throughout Test OA-310B.

The following pressure taps were omitted from Model 84-O during OA-310C: 119, 120, 142, 143, 144, 170, 171, 172, 488, and 512. The following pressure taps were plugged during Test OA-310C: 147, 406, and 506. Pressure taps numbered 210, 426, and 431 leaked during this test. It should also be noted that pressure tap 306 was found to have a bad leak prior to run 12; therefore, data obtained from tap 306 after run 11 should be considered questionable.

Kulites numbered K12, K16, K19, K21, K24, K27, K31, and K39 were the eight Kulites that were not recorded during OA-310C due to channel availability. However, Kulite K92 was giving bad data during runs 9, 10, and 11 and was replaced with Kulite K16 prior to run 12.

CONFIGURATIONS INVESTIGATED

Model Description

The model tested during Test OA-310A, B and C was a 0.035-scale model of the Space Shuttle Orbiter Vebicle, designated 84-O (see Figure 1). The model was designed to the OV102 outer moldline specifications.

All major model components are constructed of aluminum alloy. All stings and supporting hardware are constructed of stainless steel. All load-carrying components are designed to meet the ARC and LeRC maximum facility specified safety factors.

INSTRUMENTATION

The orbiter Model 84-O was supported on sting support hardware compatible with tunnel sting and strut assemblies. During Test OA-310A in the ARC 11x11-foot wind tunnel, the W-1144-S-3 sting was attached to the A9758D-125-2 Ames straight sting. It should also be noted that a clinometer was mounted inside Model 84-O only during Test OA-310A. Also, no balance was used during any portion of Test OA-310A, B and C.

During Test OA-310A, the orbiter Model 84-O was instrumented with 337 static pressure orifices. The locations of these orifices are shown in Table III. These steady-state pressures were measured utilizing eight of twelve S-type Scanivalve modules on two drive assemblies. Rockwell provided the Scanivalves, the Scanivalve drives, and the pressure transducers required. The drive assemblies were mounted in the model.

One hundred and ten high-frequency low-temperature (250°F) differential pressure transducers (Kulites) were mounted in selected locations as shown in Table IV. Rockwell Laboratory and Test representatives supported the Kulite measurements with signal conditioning, preamplification, frequency analysis, and recording equipment.

Prior to testing at LeRC (OA-310B and C), some modifications were made to the model instrumentation. First, the low-temperature (250°F) Kulites were replaced with high-temperature Kulites compensated to 350°F to accommodate the higher testing temperatures. Also, the model was modified from having an internal Scanivalve system to an external system utilizing steel tubing routed from the model to outside the test section.

During testing at LeRC, Model 84-0 was instrumented with 335 static pressure orifices of which 331 were utilized for data acquisition. These time-averaged pressures were measured using 12 electro scan pressure (ESP) modules. LeRC provided these modules and all electrical installation items necessary for their operation. Rockwell supplied the stainless steel tubing and connections to the pressure taps on the model.

All instrumentation leads and static pressure hardlines were routed externally along the main sting fixture and connected to LeRC's patchboard. The basic static pressure tap locations are as follows:

Vertical Tail	=	35
Upper Wing	=	53
Elevons	=	23
Forward Fuselage	=	21
Mid-Fuselage	=	20
Canopy	=	69
OMS	=	110
		331

Of the one hundred and eight high-frequency high-temperature differential pressure transducers (Kulites) mounted on Model 84-0, only 100 Kulites were able to be recorded due to channel availability during testing at LeRC. The basic Kulite locations on the model were as follows:

Canopy	=	24
Forward Fuselage	=	7
Aft Fuselage	=	12
Body	=	29
Vertical Tail	=	10
Wing/Elevon	=	26

Thermocouples were used to determine Kulite transducer environmental temperatures for calibration and correction purposes. The six chromel/alumel

thermocouples were installed in the vicinities of Kulite numbers 7, 29, 42, 64, 77, and 104.

TEST FACILITY DESCRIPTION

The NASA/Ames 11-foot Transonic Wind Tunnel is the transonic leg of the Ames Unitary facility. It is a closed circuit, single return, continuous flow, variable-density tunnel. The 11x11x22-foot test section is slotted to permit transonic testing. The nozzle has adjustable sidewalls. The tunnel air is driven by a 3-stage axial flow compressor powered by four wound-rotor induction motors. The speed of the motors is varied as necessary to provide the desired Mach number. The motors have a combined output of 180,000 horsepower for continuous operation or 216,000 horsepower for one hour. Tunnel temperature is controlled by aftercoolers and a cooling tower. Four 30,000 cubic-foot storage tanks provide dry air for tunnel pressurization.

The tunnel can be operated at nominal Mach numbers of 0.5 to 1.4, unit Reynolds numbers of 1.7 to 9.4 x 10^{+6} per foot, dynamic pressures of 150 to 2000 (psf), and a total temperature of 540 to 610 (^{o}R), respectively. This tunnel is used for force and moment, pressure, internal air flow/inlet, and dynamic-stability tests.

The NASA/Lewis Research Center 8x6-ft Supersonic Wind Tunnel is capable of attaining test section flow in the Mach number range from 0.36 to 2.0. The change in Mach number is continuous up to 1.3 and in increments of 0.1 between 1.3 and 2.0. The tunnel may be operated in either of two modes; aerodynamics cycle, or propulsion cycle. During the aerodynamic cycle, the tunnel is operated as a closed system with dry air added only as required to maintain the desired tunnel conditions. This cycle is used primarily for aerodynamic flow studies where contaminants are not introduced into the airstream.

The test section is 8 ft high and 6 ft wide with parallel side walls for a total length of 23 feet, 6 in. The test section is perforated on four sides. Perforations start 9 ft 1 in. from the upstream end of the test section and extend 14 ft 5 in. downstream. This perforation provides approximately 6 percent porosity; however, this can be reduced and varied along the length of the test section.

Models are installed through an access door in the bottom of the tunnel diffuser downstream of the test section. The opening is 16 ft long by 6 ft wide. Two overhead cranes are provided in the ceiling of the diffuser section. Models on special dollies are lifted into the diffuser section and rolled to the test section for installation.

Sting-mounted models are mounted to the strut which extends through the tunnel floor when supporting a model and retracted below the tunnel floor when not in use. The angle of attack can be remotely varied from 0 degrees to +15 degrees.

Two pair of Schlieren windows are located in the side walls. The 26.5-inch diameter windows are located eight inches off center in a 42.5-inch steel disc which, when rotated, allows the window to cover any portion of the 42.5-inch diameter circle.

The NASA/Lewis Research Center 10x10-foot Unitary Supersonic Wind Tunnel is a closed loop continuous flow facility with a Mach number capability from 2.0 to 3.5 in either an aerodynamic or propulsion circuit. The aerodynamic circuit, used for these investigations, has a stagnation pressure capability

of 0.1 to 2.36 atmospheres at a stagnation temperature of 1160°F giving a Reynolds number capability from 0.2 to 2.6 x 10^6/ft. The dynamic pressure varies from 20 to 720 psf. The propulsion circuit of the tunnel has a stagnation pressure capability of 0.62 to 2.36 atmospheres at a stagnation temperature of 1160°F for a Reynolds number variation of 2.1 to 2.8 x 10^6/ft and a dynamic pressure variation of 500 to 600 psf. This circuit can accept either air breathing or rocket engines for testing.

TEST PROCEDURES

During the course of Test OA-310A, B and C, data were recorded at nominal Mach numbers from 0.60 to 3.50. Data were also recorded for an angle of attack range of -6 degrees to 40 degrees and sideslip angles of -4 to +4 degrees.

Nominal entry and ascent pitch and yaw attitudes from previous flights were duplicated during the course of Test OA-310A, B and C. A summary of test conditions and runs completed during Test OA-310A, B and C is shown in Tables I and II, respectively.

DATA REDUCTION

Standard tunnel equations were used for computing all tunnel conditions. Local static-pressure coefficient data were calculated using the following equation.

$$C_p = \frac{P_L - PX144}{q}$$

Fluctuating pressure data were recorded on magnetic tape and reduced during and after the test.

Local sound pressure levels were calculated as follows:

$$dB = 20 \log \frac{P_{RMS}}{2.94 \times 10^{-9}}$$

REFERENCES

1. R. B. Kingsland and M. E. Nichols, STS83-0467, "Pretest Information for AFRSI Detailed-Environments Tests of the 0.035-Scale SSV Pressure-Loads Model 84-O in the Ames 11-foot Transonic Wind Tunnel and the Lewis 8x6-foot and 10x10-foot Supersonic Wind Tunnels (OA-310)" (July 1983)

2. NASA TM X-71542, "NASA/Lewis 8x6-ft Supersonic Wind Tunnel". (May 1974)

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TABLE I

TEST : OA-310A

DATE : 8-18-83

TEST CONDITIONS

MACH NUMBER	Total Pressure (pounds/sq. ft.)	Dynamic Pressure (pounds/sq. ft.)	
0.60	2075 → 4025	410 → 795	
0.80	1395 → 2705		
0.90	1225 → 2370		
0.95	1160 → 2250		
1.05	1070 → 2070		
1.10	1360 → 1665	540 → 660	
1.15	1325 → 1620		
1.25	1280 → 1565		
1.40	1255 → 2120	540 → 915	

BALANCE UTILIZED: NA

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF			
SF			
AF			
PM			
RM			
YM			

COMMENTS:

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TEST : OA-310B

DATE : 11-15-83

TEST CONDITIONS

MACH NUMBER	Total Pressure (pounds/sq. ft.)	Dynamic Pressure (pounds/sq. ft.)	
1.40	2505	1080	
1.60	2800	1180	

BALANCE UTILIZED: NA

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF			
SF			
AF			
PM			
RM			
YM			

COMMENTS:

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TABLE I (CONCLUDED)

TEST : OA-310C

DATE : 9-22-83

TEST CONDITIONS

MACH NUMBER	Total Pressure (pounds/sq. ft.)	Dynamic Pressure (pounds/sq. ft.)	
2.00	1120	400	
2.20	1260		
2.50	1560		
3.50	3560		

BALANCE UTILIZED: NA

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF			
SF			
AF			
PM			
RM			
YM			

COMMENTS:

TABLE II

ARC 587-1-11 SRH 1 of 5

TEST : OA310A

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE : 30 Aug 1982

DATA SET IDENTIFIER	CONFIGURATION	α	M	q	δ_{eL}	δ_{eR}	δ_{SB}	δ_R	BETA −4	BETA 0	BETA 4
RA2#01	OV102 Orbiter	A_1	0.6	600	5	5	0	0	6	9	8
02			0.8						11	12	13
03			0.9						14	15	16
04			0.95						17	18	19
05			0.6				25			7*	
06			0.6						23	24	25
07			0.8						26	27	28
08			0.9						29	30	31
09			0.95						32	33	34
10			0.6				55		57	58	59
11			0.8						54	55	56
12			0.9						51	52	53
13			.95						48	49	50
14			1.05						45	46	47
15			1.10						42	43	44
16			1.25						39	40	41
17			1.40						36	37	38
18			0.6				87.2		69	70	71

TEST RUN NUMBERS

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES

α A_1 = 2, 4, 6, 8, 10, 12

α A_2 = 2, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 12

α A_3 = −6, −4, −2, 0.

* BETA = −0.4° RUN 7 ONLY

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SEE TABLE II (CONCLUDED) FOR COMPONENT IDENTIFICATION

TABLE II (Cont'd)

ARC 587-1-11 SRH 2 of 5

TEST : OA310A	DATA SET/RUN NUMBER COLLATION SUMMARY														DATE : 30 Aug 1982		
DATA SET IDENTIFIER	CONFIGURATION	α		M	q	δ_{eL}	δ_{eR}	δ_{SB}	δ_R						BETA -4	BETA 0	BETA 4
RA2#19	OV102 Orbiter	A1		0.8	600	5	5	87.2	0						72	73	74
20				0.9											76	78	79
21				0.95											80	81	82
22				0.6				25	5						239	240	241
23				0.8											242	243	244
24				0.9											245	246	247
25				0.95											248	249	250
26				0.6				55							192	194	195
27				0.8											189	190	191
28				0.9											186	187	188
29				0.95											183	184	185
30				1.05											180	181	182
31				1.10											177	178	179
32				1.25											174	175	176
33				1.40											171	172	173
34				0.6					-5						218	219	220
35				0.8											215	216	217
36				0.9											212	213	214

TEST RUN NUMBERS

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES

NASA-MSFC-MAF

TABLE II (Cont'd)

ARC 587-1-11 SRH 3 of 5

TEST : OA310A

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE : 30 Aug 1982

DATA SET IDENTIFIER	CONFIGURATION	α		M	$\bar{q}$	δ_{EI}	δ_{EO}	δ_{SB}	δ_{R}						BETA -4	BETA 0	BETA 4
RA237	OV102 Orbiter	A1		0.95	600	5	5	55	-5						209	210	211
38				1.05											206	207	208
39				1.10											203	204	205
40				1.25											200	201	202
41				1.40											197	198	199
42				0.6				25							227	228	229
43				0.8											230	231	232
44				0.9											233	234	235
45				0.95											236	237	238
46				0.6		-5	-5	55	0						83	84	85
47				0.8											87	108	109
48				0.9											104	105	106
49				0.95											101	102	103
50				1.05											98	99	100
51				1.10											95	96	97
52				1.25											92	93	94
53				1.40											88	89	90
54				0.6		0	0								133	134	135

TEST RUN NUMBER

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES α = 2, 4, 6, 8

NASA-MSFC-MAF

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TABLE II (Cont'd)

ARC 587-1-11 SRH 4 of 5

TEST : OA310A

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE : 30 Aug 1982

DATA SET IDENTIFIER	CONFIGURATION	α	M	q	δ [illegible]	δ [illegible]	δ [illegible]	δ_R	BETA -4	BETA 0	BETA 4
RA2#55	OV102 Orbiter	A_1	0.8	600	0	0	55	0	130	131	132
56			0.9						126		127
57			0.95						123	124	125
58			1.05						120	121	122
59			1.10						117	118	119
60			1.25						114	115	116
61			1.40						111	112	113
62		A_2	0.9							128	
63		A_1	1.40	915						110	
64		A_3	0.6	600	10	9	0		168	169	170
65			0.8						165	166	167
66			0.9						162	163	164
67			0.95						159	160	161
68			1.05						156	157	158
69			1.10						153	154	155
70			1.15						150	151	152
71			1.25						147	148	149
72			1.40						144	145	146

TEST RUN NUMBERS

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR(1) IDVAR(2) NDV

α OR β SCHEDULES

NASA-MSFC-MAF

TABLE II (Cont'd)

ARC 587-1-11 SRH 5 of 5

TEST : OA310A

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE : 30 Aug 1982

DATA SET IDENTIFIER	CONFIGURATION	α		M	P_T	δ_{EI}	δ_{EO}	δ_{SB}	δ_R	BETA $-4°$	BETA 0	BETA $4°$
RA2#73	OV 102 Orbiter	6		M_1	21.6	5	5	55	0	60	61	62
74	↓	↓		M_2	29.2	↓	↓	↓	↓	63	64	65
75	↓	↓		M_1	21.6	↓	↓	↓	-5	221	222	223
76	↓	↓		M_2	29.2	↓	↓	↓	↓	224	225	226
77	↓	↓		M_1	21.6	↓	↓	↓	5	251	252	253
78	↓	↓		M_2	29.2	↓	↓	↓	↓	254	255	256
79	↓	-4		M_1	21.6	10	9	↓	0	138	139	140
80	↓	↓		M_2	29.2	↓	↓	↓	↓	141	142	143
											ALPHA	
		β		M	q	δ_{EI}	δ_{EO}	δ_{SB}	δ_R		6°	
RA2#81	OV102 Orbiter	B		0.9	600	0	0	55	0		129	

α OR β SCHEDULES / COEFFICIENTS

β B = -4, -3, -2, -1.5, -1, -.5, 0, .5, 1, 1.5, 2, 3, 4

MACH M_1 = .95, 1.05, 1.10, 1.15, 1.20, 1.25, 1.30, 1.4

MACH M_2 = .6, .7, .8, .9, .95, 1.05

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TABLE II (Cont'd)

LeRC 8X6

TEST: OA310B

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE: 12/12/83

DATA SET IDENTIFIER	CONFIGURATION	α	M	γ	δ_{EI}	δ_{EO}	δ_{SB}	δ_R	POINT #	BETA -2	BETA 0	BETA 2
RA5#01	OV102 ORBITER	A_1	1.4	1100	0	0	55	0	1212→1230	102	202*	302
02			1.6	1200	0	0		0	1231→1248	103	203	303
03			1.4	1100	5	5		5	1275→1292	105	205	305
04			1.6	1200					1257→1274	104	204	304
05			1.4	1100	-5	-5		-5	1313→1330	107	207	307
06			1.6	1200	-5	-5		-5	1295→1312	106	206	306
07		A_2	1.4	1100	10		0	0	1348→1362	109	209	309
08		A_2	1.6	1200	10		0	0	1333→1347	108	208	308

TEST RUN NUMBER

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS

IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES

α: A_1 = 5, 7, 9, 10.5, 12.5, 13.5

A_2 = -5.5, -4, -2, 0, 1.5

* α = 0, 5, 7, 9, 10.5, 12.5, 14.5 for β = 0°, D/S 01 ONLY

\# SEE TABLE II (CONCLUDED) FOR COMPONENT IDENTIFICATION

NASA-MSFC-MAF

TABLE II (Cont'd)

LeRC 10X10 PAGE 1 OF 2

TEST: OA310C

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE: 10/11/83

DATA SET IDENTIFIER	CONFIGURATION	α	M	ϕ	δ_{eL}	δ_{eR}	δ_{SB}	δ_R	POINT #	BETA −2	BETA 0	BETA 2
RA4801	OV102 ORBITER	A_1	2.0	400	5	5	55	0	72→113	101	201	301
02			2.0						129→170	401	501	601
03			2.2						171→212	102	202	302
04			2.5						213→254	103	203	303
05			3.5						255→296	104	204	304
06			2.0		-5	-5			306→347	105	205	305
07			2.2						348→389	106	206	306
08			2.5						390→431	107	207	307
09			3.5						432→473	108	208	308
10		15	M_1		0	0			488→505 509→517	109	209	309
11		A_1	2.0					5	519→560	110	210	310
12			2.5						561→602	111	211	311
13			3.5						732→773	115	215	315
14			2.0		-5	-5		-5	690→731	114	214	314
15			2.5						648→689	113	213	313
16			3.5						606→647	112	212	312
17		A_2	2.0		5	5	87.2	0	1155→1166	129	229	329
18		A_1	2.5						1063→1105*	127	227	327

*1074 SKIPPED

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES

α A_1 = 10, 12, 13.5, 14.5, 16.5, 19, 21.5, 24, 26, 29, 31, 34, 36, 37.5

MACH M_1 = 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4, 3.5

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α A_2 = 10, 11, 13, 14

M_2 2.0, 2.2, 2.4, 2.5, 2.6, 2.8, 3.0, 3.2, 3.4, 3.5

\# SEE TABLE II (CONCLUDED) FOR COMPONENT IDENTIFICATION

TABLE II (Cont'd)

LeRC 10x10 PAGE 2 OF 2

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TEST: OA310C

DATA SET/RUN NUMBER COLLATION SUMMARY

DATE: 10/11/83

DATA SET IDENTIFIER	CONFIGURATION	α	M	q	δ_{er}	δ_{eo}	δ_{SB}	δ_R		BETA -2	BETA 0	BETA 2
RA4 19	OV102 ORBITER	A_1	3.5	400	5	5	87.2	0	1106 → 1133, 1141 → 1154	128	228	328
20		A_3							1134 → 1139			628
21		A_4	2.0		0	-5	0		838 → 852	120	220	320
22			2.2						823 → 837	119	219	319
23			2.5						804 → 818	118	218	318
24			3.5						774 → 788	116	216	316
25		2	M_2						①	117	217	317
26		A_5	2.0		5	5	55		853 → 914*	121	221	321
27			2.5						915 → 974	122	222	322
28			3.5						975 → 1034	123	223	323
										ALPHA 12.7	ALPHA 21.0	ALPHA 23.0
		β	M	q	δ_{er}	δ_{eo}	δ_{SB}	δ_R				
RA4 29	OV102 ORBITER	B_1	2.5	400	5	5	55	0		126		
30		B_1	3.5	400	5	5	55	0			224	325

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICIENTS IDVAR (1) IDVAR (2) NDV

α OR β SCHEDULES

α $A_3 = 9, 11, 12, 13.5$ β $B_1 = -2 \rightarrow +2 (\Delta\beta = .5)$

$A_4 = -2, 0, 1.5, 3.5, 5.0$ $A_5 = 15 \rightarrow 19 (\Delta\alpha = 1), 19.5 \rightarrow 23 (\Delta\alpha = .5), 24 \rightarrow 29 (\Delta\alpha = 1)$

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① 776, 781, 786, 789 → 803, 806, 811, 816, 820 → 822, 825, 830, 835, 840, 845, 850

* SKIPPED 874 + 875

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TABLE II (Concluded)

DATASET/RUN NUMBER COLLATION SUMMARY
INDEX TO DATA TABULATIONS

Dataset Fourth Character	Component Description	ØA310A		ØA310B		ØA310C	
		Tab Pg.No.	Fiche Pg.No.	Tab Pg.No.	Fiche Pg.No.	Tab Pg.No.	Fiche Pg.No.
C	Canopy and Forward Fuselage	1-1054	1-18	1-109	1- 2	1- 804	1-13
B	Fwd. Side Fuselage	1055-1584	18-26	110-163	2- 3	805-1185	13-19
M	Mid-Side Fuselage	1585-2186	26-35	164-225	3- 4	1186-1620	19-26
Ø	OMS and Aft Fuselage	2187-2869	35-46	226-296	4- 5	1621-2150	26-35
L	Left Surface of Vertical Tail	2870-3552	46-57	297-367	5- 6	2151-2680	35-43
R	Right Surface of Vertical Tail	3553-4165	57-67	368-430	6- 7	2681-3168	43-51
U	Upper Wing (Left)	4166-5982	67-96	431-616	7-10	3169-4574	51-73
Z	Upper Wing (Right)	N/T	N/T	617-654	10-11	4575-4854	73-78

OF POOR

TABLE III. STATIC PRESSURE ORIFICE LOCATIONS

Vertical Tail

ORIF NUMB #	FULL SCALE ZO	% CHORD (X/C)	MODEL SCALE X	MODEL SCALE Z
2	600	0.000	48.226	21.000
3	600	0.030	48.454	21.000
4	600	0.060	48.683	21.000
5	600	0.150	49.369	21.000
6	600	0.300	50.513	21.000
7	600	0.520	52.190	21.000
8	600	0.680	53.410	21.000
9	600	0.800	54.324	21.000
10	600	1.000	55.843	21.000
11	600	0.000	51.026	23.800
12	680	0.030	51.212	23.800
13	680	0.060	51.398	23.800
14	680	0.150	51.956	23.800
15	680	0.220	52.391	23.800
16	680	0.300	52.887	23.800
17	680	0.390	53.445	23.800
18	680	0.470	53.942	23.800
19	680	0.520	54.252	23.800
20	680	0.620	54.872	23.800
21	680	0.680	55.245	23.800
22	680	0.770	55.803	23.800
23	680	0.830	56.175	23.800
24	680	0.930	56.796	23.800
25	680	0.990	57.168	23.800
26	760	0.000	53.826	26.600
27	760	0.030	53.969	26.600
28	760	0.060	54.113	26.600
29	760	0.150	54.543	26.600
30	760	0.300	55.261	26.600
31	760	0.520	56.314	26.600
32	760	0.680	57.079	26.600
33	760	0.775	57.534	26.600
34	760	0.830	57.797	26.600
35	760	0.900	58.132	26.600
36	760	1.000	58.611	26.600

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS
(Continued)

Upper Wing

ORIF NUMB #	FULL SCALE YO	% SPAN N	% CHORD (X/C)	MODEL SCALE X	MODEL SCALE Y
102	-200.0	0.427	0.000	35.660	-7.000
103	-200.0	0.427	0.010	35.825	-7.000
104	-200.0	0.427	0.020	35.990	-7.000
105	-200.0	0.427	0.050	36.484	-7.000
106	-200.0	0.427	0.080	36.979	-7.000
107	-200.0	0.427	0.100	37.309	-7.000
108	-200.0	0.427	0.130	37.803	-7.000
109	-200.0	0.427	0.150	38.133	-7.000
110	-200.0	0.427	0.180	38.627	-7.000
111	-200.0	0.427	0.200	38.957	-7.000
112	-200.0	0.427	0.250	39.781	-7.000
113	-200.0	0.427	0.290	40.440	-7.000
114	-200.0	0.427	0.330	41.099	-7.000
115	-200.0	0.427	0.370	41.759	-7.000
116	-200.0	0.427	0.400	42.253	-7.000
117	-200.0	0.427	0.550	44.725	-7.000
118	-200.0	0.427	0.724	47.593	-7.000
119	-200.0	0.427	0.759	48.170	-7.000
120	-200.0	0.427	0.803	48.895	-7.000
121	-200.0	0.427	0.825	49.258	-7.000
122	-200.0	0.427	0.869	49.983	-7.000
123	-200.0	0.427	0.913	50.708	-7.000
124	-200.0	0.427	0.956	51.417	-7.000
125	-200.0	0.427	0.998	52.109	-7.000
126	-365.3	0.780	0.000	42.046	-12.786
127	-365.3	0.780	0.010	42.136	-12.786
128	-365.3	0.780	0.020	42.227	-12.786
129	-365.3	0.780	0.050	42.499	-12.786
130	-365.3	0.780	0.080	42.771	-12.786
131	-365.3	0.780	0.130	43.225	-12.786
132	-365.3	0.780	0.150	43.406	-12.786
133	-365.3	0.780	0.200	43.860	-12.786
134	-365.3	0.780	0.250	44.313	-12.786
135	-365.3	0.780	0.300	44.767	-12.786
136	-365.3	0.780	0.350	45.220	-12.786
137	-365.3	0.780	0.400	45.674	-12.786
138	-365.3	0.780	0.450	46.127	-12.786
139	-365.3	0.780	0.500	46.581	-12.786
140	-365.3	0.780	0.550	47.034	-12.786
141	-365.3	0.780	0.612	47.597	-12.786

TABLE III. STATIC PRESSURE ORIFICE LOCATIONS

(Continued)

Upper Wing

ORIF NUMB # .	FULL SCALE YO	% SPAN H	% CHORD (X/C)	MODEL SCALE X	MODEL SCALE Y
142	-365.3	0.780	0.660	48.032	-12.786
143	-365 3	3.780	0.688	48.286	-12.786
144	-365.3	0.780	0.745	48.803	-12.786
145	-365.3	0.790	0.773	49.057	-12.786
146	-365.3	0.780	0.802	49.320	-12.786
147	-365.3	0.780	0.830	49.574	-12.786
148	-365.3	0.780	0.858	49.828	-12.786
149	-365.3	0.780	0.887	50.091	-12.786
150	-365.3	0.780	0.915	50.345	-12.786
151	-365.3	0.780	0.943	50.599	-12.786
152	-365.3	0.780	0.972	50.862	-12.786
153	-365.3	0.780	0.997	51.089	-12.786
154	-420.1	0.897	0.000	43.964	-14.704
155	-420.1	0.897	0.010	44.032	-14.704
156	-420.1	0.897	0.020	44.100	-14.704
157	-420.1	0.897	0.050	44.304	-14.704
158	-420.1	0.897	0.080	44.509	-14.704
159	-420.1	0.897	0.100	44.645	-14.704
160	-420.1	0.897	0.130	44.849	-14.704
161	-420.1	0.897	0.150	44.985	-14.704
162	-420.1	0.897	0.200	45.326	-14.704
163	-420.1	0.897	0.250	45.667	-14.704
164	-420.1	0.897	0.300	46.007	-14.704
165	-420.1	0.897	0.350	46.348	-14.704
166	-420.1	0.897	0.400	46.689	-14.704
167	-420.1	0.897	0.450	47.029	-14.704
168	-420.1	0.897	0.500	47.370	-14.704
169	-420.1	0.897	0.534	47.601	-14.704
170	-420.1	0.897	0.607	48.099	-14.704
171	-420.1	0.897	0.640	48.324	-14.704
172	-420.1	0.897	0.705	48.766	-14.704
173	-420.1	0.897	0.738	48.991	-14.704
174	-420.1	0.897	0.771	49.216	-14.704
175	-420.1	0.897	0.804	49.441	-14.704
176	-420.1	0.897	0.836	49.659	-14.704
177	-420.1	0.897	0.869	49.884	-14.704
178	-420.1	0.897	0.902	50.108	-14.704
179	-420.1	0.897	0.935	50.333	-14.704
180	-420.1	0.897	0.967	50.551	-14.704
181	-420.1	0.897	0.997	50.756	-14.704

TABLE III. STATIC PRESSURE ORIFICE LOCATIONS

(Continued)

Forward Side Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE ZO	MODEL SCALE X	MODEL SCALE Z
202	590	350	20.650	12.250
203	625	350	21.875	12.250
204	690	350	24.150	12.250
205	625	360	21.875	12.600
206	625	375	21.875	13.125
207	625	385	21.875	13.475
208	590	400	20.650	14.000
209	600	400	21.000	14.000
210	615	400	21.525	14.000
211	625	400	21.875	14.000
212	640	400	22.400	14.000
213	650	400	22.750	14.000
214	665	400	23.275	14.000
215	675	400	23.625	14.000
216	690	400	24.150	14.000
217	625	415	21.875	14.525
218	625	430	21.875	15.050
219	625	445	21.875	15.575
220	590	460	20.650	16.100
221	625	460	21.875	16.100
222	690	460	24.150	16.100

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS

(Continued)

Mid Side Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE ZO	MODEL SCALE X	MODEL SCALE Z
223	928	360	32.480	12.600
224	1006	360	35.210	12.600
225	1070	360	37.450	12.600
226	1006	380	35.210	13.300
227	1006	391	35.210	13.685
228	928	400	32.480	14.000
229	942	400	32.970	14.000
230	958	400	33.530	14.000
231	970	400	33.950	14.000
232	990	400	34.650	14.000
233	1006	400	35.210	14.000
234	1020	400	35.700	14.000
235	1036	400	36.260	14.000
236	1054	400	36.890	14.000
237	1070	400	37.450	14.000
238	1006	415	35.210	14.525
239	1006	430	35.210	15.050
240	928	460	32.480	16.100
241	1006	460	35.210	16.100
242	1070	460	37.450	16.100

TABLE III.- STATIC PRESSURE ORIFICE LOCATIONS

(Continued)

Canopy and Forward Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE YO	STA ANGLE PHI	MODEL SCALE X	MODEL SCALE Y
302	350	0.0	180	12.250	0.000
303	360	0.0	180	12.600	0.000
304	370	0.0	180	12.950	0.000
305	380	0.0	180	13.300	0.000
306	390	0.0	180	13.650	0.000
307	400	0.0	180	14.000	0.000
308	410	0.0	180	14.350	0.000
309	420	0.0	180	14.700	0.000
310	430	0.0	180	15.050	0.000
311	440	0.0	180	15.400	0.000
312	450	0.0	180	15.750	0.000
313	460	0.0	180	16.100	0.000
314	470	0.0	180	16.450	0.000
315	480	0.0	180	16.800	0.000
316	490	0.0	180	17.150	0.000
317	500	0.0	180	17.500	0.000
318	510	0.0	180	17.850	0.000
319	520	0.0	180	18.200	0.000
320	530	0.0	180	18.550	0.000
321	540	0.0	180	18.900	0.000
322	550	0.0	180	19.250	0.000
323	560	0.0	180	19.600	0.000
324	570	0.0	180	19.950	0.000
325	580	0.0	180	20.300	0.000
326	590	0.0	180	20.650	0.000
327	380	-17.0	165	13.300	-0.595
328	420	-19.0	165	14.700	-0.665
329	450	-22.0	165	15.750	-0.770
330	470	-26.5	165	16.450	-0.928
331	500	-21.5	165	17.500	-0.753
332	540	-28.0	165	18.900	-0.980
333	350	-30.0	150	12.250	-1.050
334	360	-31.5	150	12.600	-1.103
335	370	-33.0	150	12.950	-1.155
336	380	-33.5	150	13.300	-1.173
337	390	-34.5	150	13.650	-1.208
338	400	-35.5	150	14.000	-1.243
339	410	-36.5	150	14.350	-1.278
340	420	-38.0	150	14.700	-1.330
341	430	-39.0	150	15.050	-1.365
342	440	-40.0	150	15.400	-1.400
343	450	-42.0	150	15.750	-1.470
344	460	-44.5	150	16.100	-1.558
345	470	-46.5	150	16.450	-1.628
346	480	-49.5	150	16.800	-1.733
347	490	-52.0	150	17.150	-1.820
348	500	-52.5	150	17.500	-1.838
349	510	-53.0	150	17.850	-1.855
350	520	-53.5	150	18.200	-1.873

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS

(Continued)

Canopy and Forward Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE YO	STA ANGLE PHI	MODEL SCALE X	MODEL SCALE Y
351	530	-54.0	150	18.550	-1.890
352	540	-54.0	150	18.900	-1.890
353	550	-54.0	150	19.250	-1.890
354	560	-53.0	150	19.600	-1.855
355	570	-52.5	150	19.950	-1.838
356	580	-52.0	150	20.300	-1.820
357	590	-51.7	150	20.650	-1.810
358	350	-57.5	120	12.250	-2.013
359	370	-61.0	120	12.950	-2.135
360	390	-65.5	120	13.650	-2.293
361	410	-70.0	120	14.350	-2.450
362	430	-74.0	120	15.050	-2.590
363	460	-78.5	120	16.100	-2.748
364	470	-82.0	120	16.450	-2.870
365	490	-86.0	120	17.150	-3.010
366	510	-89.5	120	17.850	-3.133
367	530	-91.0	120	18.550	-3.185
368	550	-92.5	120	19.250	-3.238
369	570	-95.0	120	19.950	-3.325
370	590	-97.5	120	20.650	-3.413

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS (Continued)

OMS Pods and Aft Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	STA ANGLE PHI	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
402	1215	----	400.0	90	42.525	-----	14.000
403	1245	----	400.0	90	43.575	-----	14.000
404	1265	----	400.0	90	44.275	-----	14.000
405	1285	----	400.0	90	44.975	-----	14.000
406	1300	----	400.0	90	45.500	-----	14.000
407	1306	----	400.0	90	45.710	-----	14.000
408	1312	----	400.0	90	45.920	-----	14.000
409	1318	----	400.0	90	46.130	-----	14.000
410	1325	----	400.0	90	46.375	-----	14.000
411	1330	----	400.0	90	46.550	-----	14.000
412	1350	----	400.0	90	47.250	-----	14.000
413	1375	----	400.0	90	48.125	-----	14.000
414	1430	----	400.0	90	50.050	-----	14.000
415	1215	----	429.7	105	42.525	-----	15.040
416	1245	----	429.7	105	43.575	-----	15.040
417	1265	----	429.7	105	44.275	-----	15.040
418	1285	----	429.7	105	44.975	-----	15.040
419	1300	----	429.7	105	45.500	-----	15.040
420	1306	----	429.7	105	45.710	-----	15.040
421	1312	----	429.7	105	45.920	-----	15.040
422	1318	----	432.7	105	46.130	-----	15.145
423	1325	----	[illegible]4.1	105	46.375	-----	15.194
424	1330	----	4[illegible].2	105	46.550	-----	15.232
425	1350	----	435.6	105	47.250	-----	15.246
426	1375	----	436.2	105	48.125	-----	15.267
427	1430	----	439.2	105	50.050	-----	15.372
428	1215	----	439.6	110	42.525	-----	15.386
429	1245	----	439.6	110	43.575	-----	15.386
430	1265	----	439.6	110	44.275	-----	15.386
431	1285	----	439.6	110	44.975	-----	15.386
432	1300	----	439.6	110	45.500	-----	15.386
433	1306	----	439.6	110	45.710	-----	15.385
434	1312	----	439.6	110	45.920	-----	15.[illegible]6
435	1318	----	441.6	110	46.130	-----	15.456
436	1325	----	444.2	110	46.375	-----	15.547
437	1330	----	445.5	110	46.550	-----	15.593
438	1350	----	448.5	110	47.250	-----	15.698
439	1375	----	451.9	110	48.125	-----	15.817
440	1430	----	455.4	110	50.050	-----	15.939
441	1215	----	459.4	120	42.525	-----	16.079
442	1245	----	459.4	120	43.575	-----	16.079
443	1265	----	459.4	120	44.275	-----	16.079
444	1285	----	459.4	120	44.975	-----	16.079
445	1300	----	459.4	120	45.500	-----	16.079
446	1306	----	459.4	120	45.710	-----	16.079
447	1312	----	460.0	120	45.920	-----	16.100
448	1318	----	463.4	120	46.130	-----	16.219
449	1325	----	467.3	120	46.375	-----	16.356
450	1330	----	469.3	120	46.550	-----	16.426

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS
(Continued)
OMS Pods and Aft Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	STR ANGLE PHI	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
451	1350	----	474.9	120	47.250	-----	16.622
452	1375	----	479.2	120	48.125	-----	16.772
453	1430	----	482.8	120	50.050	-----	16.898
454	1215	-76.8	-----	135	42.525	-2.688	------
455	1245	-76.8	-----	135	43.575	-2.688	------
456	1265	-76.8	-----	135	44.275	-2.688	------
457	1285	-76.8	-----	135	44.975	-2.688	------
458	1300	-76.8	-----	135	45.500	-2.688	------
459	1306	-76.8	-----	135	45.710	-2.688	------
460	1312	-83.2	-----	135	45.920	-2.912	------
461	1318	-87.1	-----	135	46.130	-3.049	------
462	1325	-92.1	-----	135	46.375	-3.224	------
463	1330	-95.0	-----	135	46.550	-3.325	------
464	1350	-103.6	-----	135	47.250	-3.626	------
465	1375	-107.9	-----	135	48.125	-3.777	------
466	1430	-112.5	-----	135	50.050	-3.938	------
467	1215	-52.3	-----	150	42.525	-1.831	------
468	1245	-52.3	-----	150	43.575	-1.831	------
469	1265	-52.3	-----	150	44.275	-1.831	------
470	1285	-52.3	-----	150	44.975	-1.831	------
471	1300	-52.3	-----	150	45.500	-1.831	------
472	1306	-52.3	-----	150	45.710	-1.831	------
473	1312	-55.4	-----	150	45.920	-1.939	------
474	1318	-5[illegible].4	-----	150	46.130	-2.079	------
475	1325	-62.4	-----	150	46.375	-2.184	------
476	1330	-64.7	-----	150	46.550	-2.265	------
477	1350	-70.3	-----	150	47.250	-2.461	------
478	1375	-75.2	-----	150	48.125	-2.632	------
479	1430	-76.8	-----	150	50.050	-2.688	------
480	1215	-25.3	-----	165	42.525	-0.886	------
481	1245	-25.3	-----	165	43.575	-0.886	------
482	1265	-25.3	-----	165	44.275	-0.886	------
483	1285	-25.3	-----	165	44.975	-0.886	------
484	1300	-25.3	-----	165	45.500	-0.886	------
485	1306	-25.3	-----	165	45.710	-0.886	------
486	1312	-26.3	-----	165	45.920	-0.921	------
487	1318	-27.3	-----	165	46.130	-0.956	------
488	1325	-28.5	-----	165	46.375	-0.998	------
489	1330	-28.7	-----	165	46.550	-1.005	------
490	1350	-28.3	-----	165	47.250	-0.991	------
491	1375	-27.7	-----	165	48.125	-0.970	------
492	1430	-30.7	-----	165	50.050	-1.075	------
493	1465	-33.0	-----	165	51.275	-1.155	------
494	1500	-34.0	-----	165	52.500	-1.190	------
495	1215	-15.8	-----	174	42.525	-0.553	------
496	1245	-15.8	-----	174	43.575	-0.553	------
497	1265	-15.8	-----	174	44.275	-0.553	------
498	1285	-15.8	-----	174	44.975	-0.553	------
499	1300	-15.8	-----	174	45.500	-0.553	------
500	1306	-15.8	-----	174	45.710	-0.553	------

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TABLE III. STATIC PRESSURE ORIFICE LOCATIONS
(Concluded)

OMS Pods and Aft Fuselage

ORIF NUMB #	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	STA ANGLE PHI	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
501	1312	-15.8	-----	174	45.920	0.553	-----
502	1318	-15.8	-----	174	46.130	0.553	-----
503	1325	-15.8	-----	174	46.375	-0.553	------
504	1330	-15.8	-----	174	46.550	-0.553	------
505	1350	-15.8	-----	174	47.250	-0.553	------
506	1375	-15.8	-----	174	48.125	-0.553	------
507	1430	-14.9	-----	174	50.050	-0.522	------
508	1215	0.0	-----	180	42.525	0.000	------
509	1245	0.0	-----	180	43.575	0.000	------
510	1265	0.0	-----	180	44.275	0.000	------
511	1285	0.0	-----	180	44.975	0.000	------
512	1300	0.0	-----	180	45.500	0.000	------
513	1306	0.0	-----	180	45.710	0.000	------

Table IV Kulite Locations

KULI NUMB	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
1	370	0	---	12.950	0.000	-----
2	370	-20	---	12.950	-0.700	-----
3	415	0	---	14.525	0.000	-----
4	415	-20	---	14.525	-0.700	-----
5	415	-40	---	14.525	-1.400	-----
6	415	-55	---	14.525	-1.925	-----
7	440	0	---	15.400	0.000	-----
8	440	-20	---	15.400	-0.700	-----
9	440	-40	---	15.400	-1.400	-----
10	440	-55	---	15.400	-1.925	-----
11	460	0	---	16.100	0.000	-----
12	460	-20	---	16.100	-0.700	-----
13	480	0	---	16.800	0.000	-----
14	480	-20	---	16.800	-0.700	-----
15	480	-40	---	16.800	-1.400	-----
16	500	0	---	17.500	0.000	-----
17	500	-20	---	17.500	-0.700	-----
18	500	-40	---	17.500	-1.400	-----
19	500	-55	---	17.500	-1.925	-----
20	520	0	---	18.200	0.000	-----
21	520	-20	---	18.200	-0.700	-----
22	520	-40	---	18.200	-1.400	-----
23	560	0	---	19.600	0.000	-----
24	560	-40	---	19.600	-1.400	-----
25	580	--	400	20.300	-----	14.000
26	600	--	420	21.000	-----	14.700
27	600	--	380	21.000	-----	13.300
28	620	--	460	21.700	-----	16.100
29	620	--	400	21.700	-----	14.000
30	620	--	350	21.700	-----	12.250
31	640	--	420	22.400	-----	14.700
32	640	--	380	22.400	-----	13.300
33	690	--	400	24.150	-----	14.000
37	920	--	400	32.200	-----	14 000
38	920	--	350	32.200	-----	12.250
39	950	--	400	33.250	-----	14 000
40	1000	--	460	35.000	-----	16.100
41	1000	--	420	35.000	-----	14.700
42	1000	--	400	35.000	-----	14.000
43	1000	--	380	35.000	-----	13.300
44	1000	--	350	35.000	-----	12.250
45	1035	--	400	36.225	-----	14.000
46	1070	--	400	37.450	-----	14.000
47	1070	--	350	37.450	-----	12.250
48	1140	--	400	39.900	-----	14.000
49	1200	--	460	42.000	-----	16.100
50	1200	--	400	42.000	-----	14.000

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Table IV Kulite Locations (Continued)

KULI NUMB	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
51	1260	0	---	44.100	0.000	-----
52	1260	-75	---	44.100	-2.625	-----
53	1280	-40	---	44.800	-1.400	-----
54	1280	-75	---	44.800	-2.625	-----
55	1280	--	460	44.800	-----	16.100
56	1300	0	---	45.500	0.000	-----
57	1300	-20	---	45.500	-0.700	-----
58	1300	-40	---	45.500	-1.400	-----
59	1300	-75	---	45.500	-2.625	-----
60	1300	--	460	45.500	-----	16.100
61	1320	-20	---	46.200	-0.700	-----
62	1320	-40	---	46.200	-1.400	-----
63	1320	-75	---	46.200	-2.625	-----
64	1320	--	460	46.200	-----	16.100
65	1320	--	400	46.200	-----	14.000
66	1340	-20	---	46.900	-0.700	-----
67	1340	-40	---	46.900	-1.400	-----
68	1340	-75	---	46.900	-2.625	-----
69	1340	--	460	46.900	-----	16.100
70	1340	--	400	46.900	-----	14.000
71	1380	-75	---	48.300	-2.625	-----
72	1420	-20	---	49.700	-0.700	-----
73	1420	-75	---	49.700	-2.625	-----
74	1420	--	400	49.700	-----	14.000
75	1480	-20	---	51.800	-0.700	-----
76	1480	-75	---	51.800	-2.625	-----
77	1000	-140	---	35.000	-4.900	-----
78	1035	-140	---	36.225	-4.900	-----
79	1035	-190	---	36.225	-6.650	-----
80	1070	-140	---	37.450	-4.900	-----
81	1070	-190	---	37.450	-6.650	-----
82	1070	-220	---	37.450	-7.700	-----
83	1090	-140	---	38.150	-4.900	-----
84	1090	-190	---	38.150	-6.650	-----
85	1090	-220	---	38.150	-7.700	-----
86	1140	-140	---	39.900	-4.900	-----
87	1140	-190	---	39.900	-6.650	-----
88	1140	-220	---	39.900	-7.700	-----
89	1200	-140	---	42.000	-4.900	-----
90	1280	-380	---	44.800	-13.300	-----
91	1300	-380	---	45.500	-13.300	-----
92	1320	-380	---	46.200	-13.300	-----
93	1340	-340	---	46.900	-11.900	-----
94	1340	-360	---	46.900	-12.600	-----
95	1340	-380	---	46.900	-13.300	-----
96	1340	-400	---	46.900	-14.000	-----
97	1340	-420	---	46.900	-14.700	-----
98	1400	-380	---	49.000	-13.300	-----
99	1420	-360	---	49.700	-12.600	-----
100	1420	-380	---	49.700	-13.300	-----

Table IV Kulite Locations (Concluded)

KULI NUMB	FULL SCALE XO	FULL SCALE YO	FULL SCALE ZO	MODEL SCALE X	MODEL SCALE Y	MODEL SCALE Z
101	1420	-420	---	49.700	-14.700	-----
102	1440	-380	---	50.400	-13.300	-----
103	1520	--	680	53.200	-----	23.800
104	1380	--	560	48.300	-----	19.600
105	1540	--	680	53.900	-----	23.800
106	1630	--	780	57.050	-----	27.300
107	1580	--	720	55.300	-----	25 200
108	1550	--	700	54.250	-----	24 500
109	1560	--	680	54.600	-----	23.800
110	1530	--	650	53.550	-----	22.750
111	1490	--	560	52.150	-----	19.600
112	1595	--	660	55.825	-----	23.800
113	1620	--	680	56.700	-----	23.800

TABLE V

LIST OF BAD DATA POINTS

ØA310A

COMPONENT	IDENTIFIER	M	β	α	TAP NUMBERS
Canopy and Forward Fuselage	RA2C04	0.95	4	6	333 through 370
	RA2C70	1.15	4	-2	ALL
	RA2C73	1.155 +1.217	4	6	ALL
Forward Side Fuselage	RA2B70	1.15	4	-2	ALL
	RA2B73	1.155 +1.217	4	6	ALL
Mid-Side Fuselage	RA2M04	0.95	4	6	228 through 239
	RA2M70	1.15	4	-2	ALL
OMS and Aft Fuselage	RA2Ø04	0.95	4	6	428 through 453 467 through 494
	RA2Ø70	1.15	4	-2	ALL
	RA2Ø73	1.155 +1.217	4	6	ALL
Left Surface of Vertical Tail	RA2L18-21	ALL	ALL	ALL	20
	RA2L70	1.15	4	-2	ALL
	RA2L73	1.155 +1.217	4	6	ALL
Right Surface of Vertical Tail	RA2R70	1.15	4	-2	ALL
	RA2R73	1.155 +1.217	4	6	ALL
Upper Wing (Left)	RA2U04	0.95	4	6	132 through 145 176 through 180
	RA2U70	1.15	4	-2	ALL
	RA2U73	1.15 +1.217	4	6	ALL

TABLE V. (Cont'd)

ØA310B

COMPONENT	IDENTIFIER	M	β	α	TAP NUMBERS
OMS and Aft Fuselage	ALL	ALL	ALL	ALL	406,426,488,512
Upper Wing (Left)	ALL	ALL	ALL	ALL	119,120,142 through 144, 170 through 172

ØA310C

COMPONENT	IDENTIFIER	M	β	α	TAP NUMBERS
Canopy and Forward Fuselage	RA4C06-08	ALL	ALL	ALL	341
	RA4C10	1.99 +2.17 +2.37	ALL	15	352,355 through 357
Forward Side Fuselage	RA4B10	2.17 +2.37	ALL	15	210
OMS and Aft Fuselage	ALL	ALL	ALL	ALL	406,426,488,506,512
	RA4Ø17-20	ALL	ALL	ALL	412,482
	RA4Ø21-25	ALL	ALL	ALL	482
	RA4Ø26-28	ALL	ALL	ALL	412,482
Left Surface of Vertical Tail	RA4L01	2.0	ALL	ALL	22
	RA4L01	2.0	-2	ALL	18
	RA4L01	2.0	0	24 to 40	18
	RA4L01	2.0	2	26 to 40	18
	RA4L05 & 09	3.5	-2	25 to 38	22
	RA4L21-25	ALL	ALL	ALL	22
Right Surface of Vertical Tail	RA4R05 & 09	3.5	ALL	25 to 38	35
	RA4R13	3.5	ALL	24 to 38	35
	RA4R21-25	ALL	ALL	ALL	35

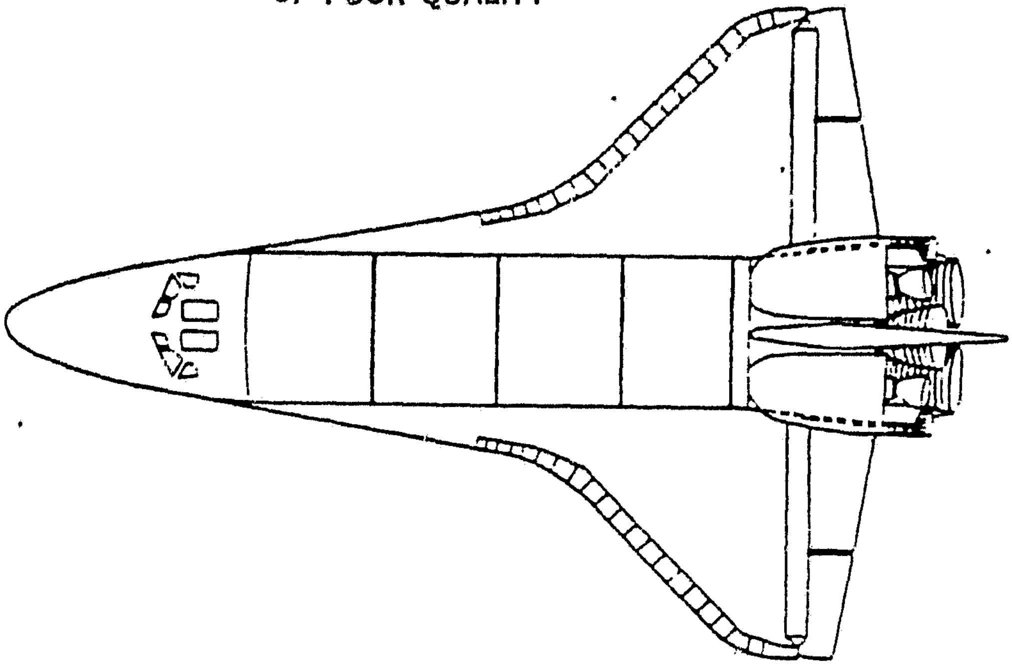
TABLE V. (Cont'd)

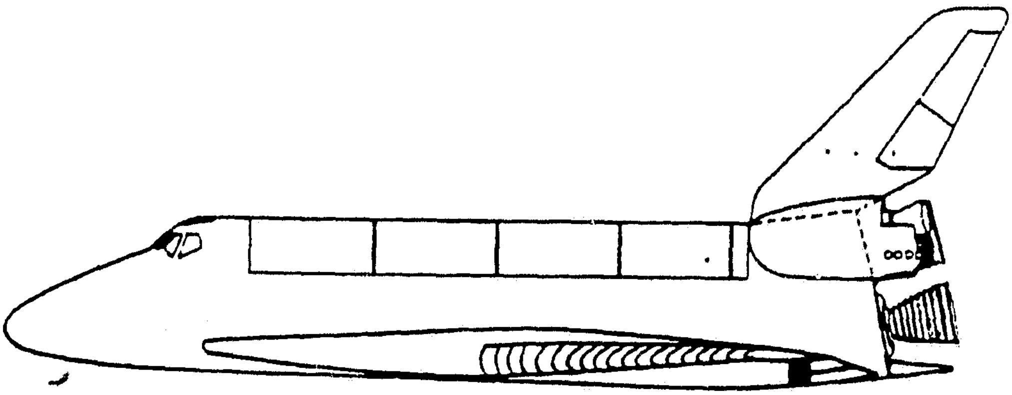
ØA310C (Cont'd)

COMPONENT	IDENTIFIER	M	β	α	TAP NUMBERS
Upper Wing (Left)	ALL	ALL	ALL	ALL	119,120,142 through 144, 170 through 172
	RA4U01-09	ALL	ALL	ALL	130 through 133,135, 137 through 141,147, 148, 150 through 153, 159
	RA4U06-09	ALL	ALL	ALL	145
	RA4U10	1.99 +2.17 +2.37	ALL	15	ALL
	RA4U11	2.0	ALL	10 to 24	147,150
	RA4U13	3.5	-2,0	ALL	147
	RA4U17	2.0	ALL	ALL	147,150
	RA4U17	2.0	-2	ALL	134
	RA4U18	2.5	-2	ALL	147
	RA4U19	3.5	ALL	ALL	147,150
	RA4U19	3.5	-2	ALL	134,136
	RA4U21	2.0	-2	ALL	147,150
	RA4U21	2.0	0	2,4,6	147,150
	RA4U21	2.0	2	-2,0,4,6	147,150
	RA4U22	2.2	ALL	2,4,6	147,150
	RA4U24	3.5	ALL	ALL	147
	RA4U26	2.0	-2	15 to 22.4	147
	RA4U27	2.5	2	ALL	147
	RA4U28	3.5	ALL	ALL	134,136,147
	RA4U29	2.5	-2 to 0	12.7	134,136

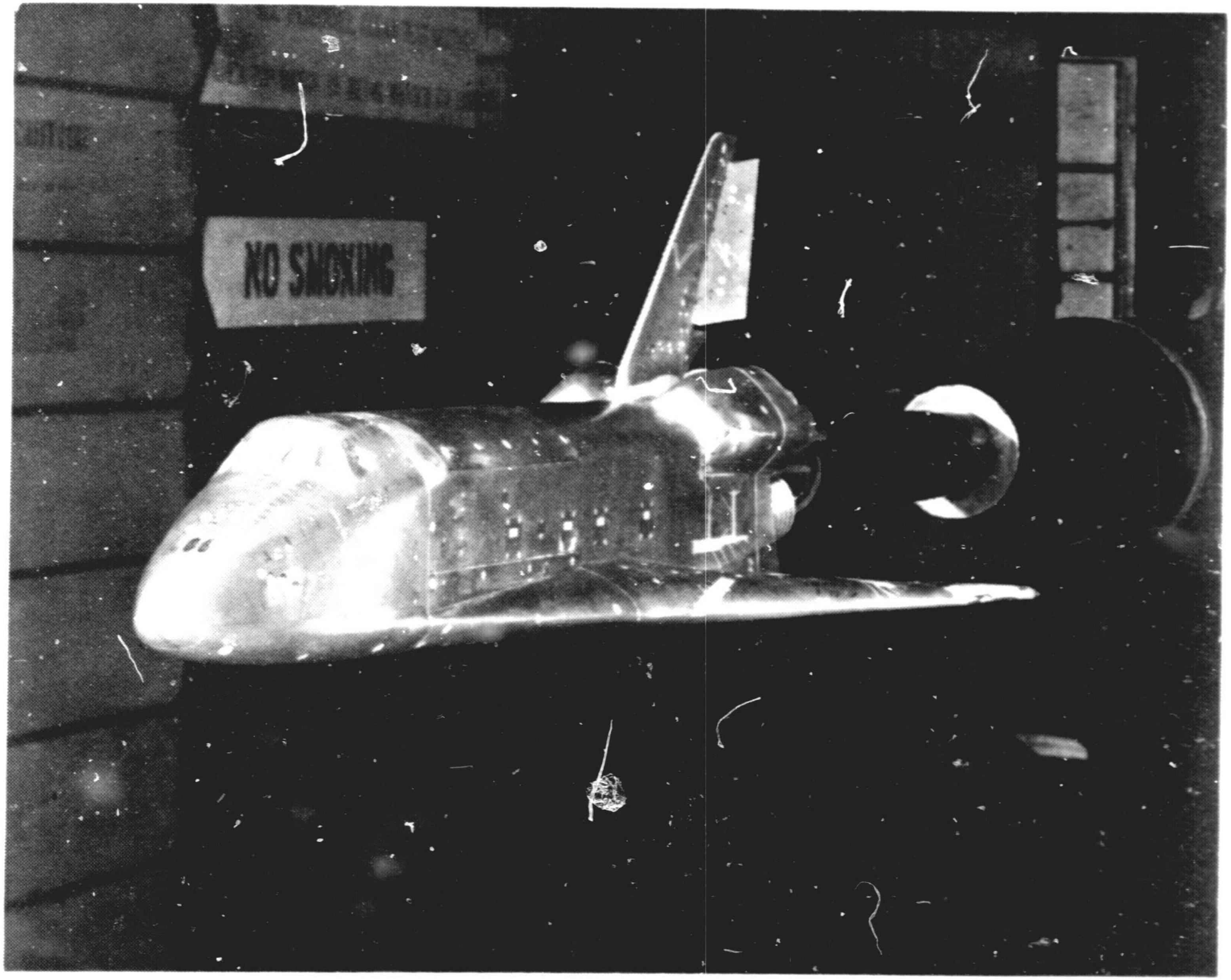
TABLE V. (Concluded)

COMPONENT	IDENTIFIER	M	β	α	TAP NUMBERS
	RA4U29	2.5	ALL	12.7	147,150
	RA4U30	3.5	ALL	ALL	136
	RA4U30	3.5	ALL	21	147,150
	RA4U30	3.5	-2 to 0	23	147





a. Sketch of Space Shuttle Orbiter Model 84-0
Figure 1. Model Sketches



a. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Ames Research Center 11x11 foot Transonic Wind Tunnel

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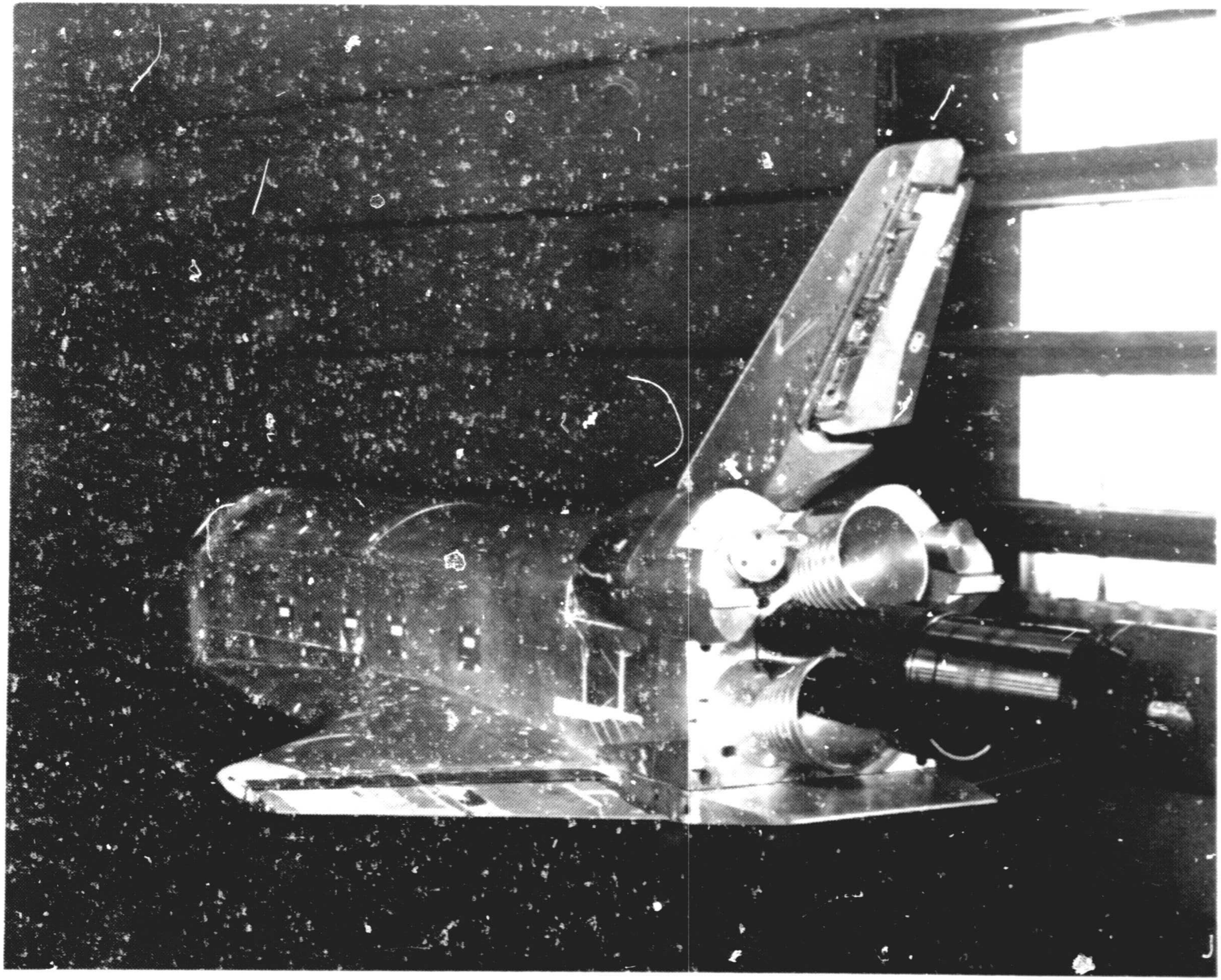
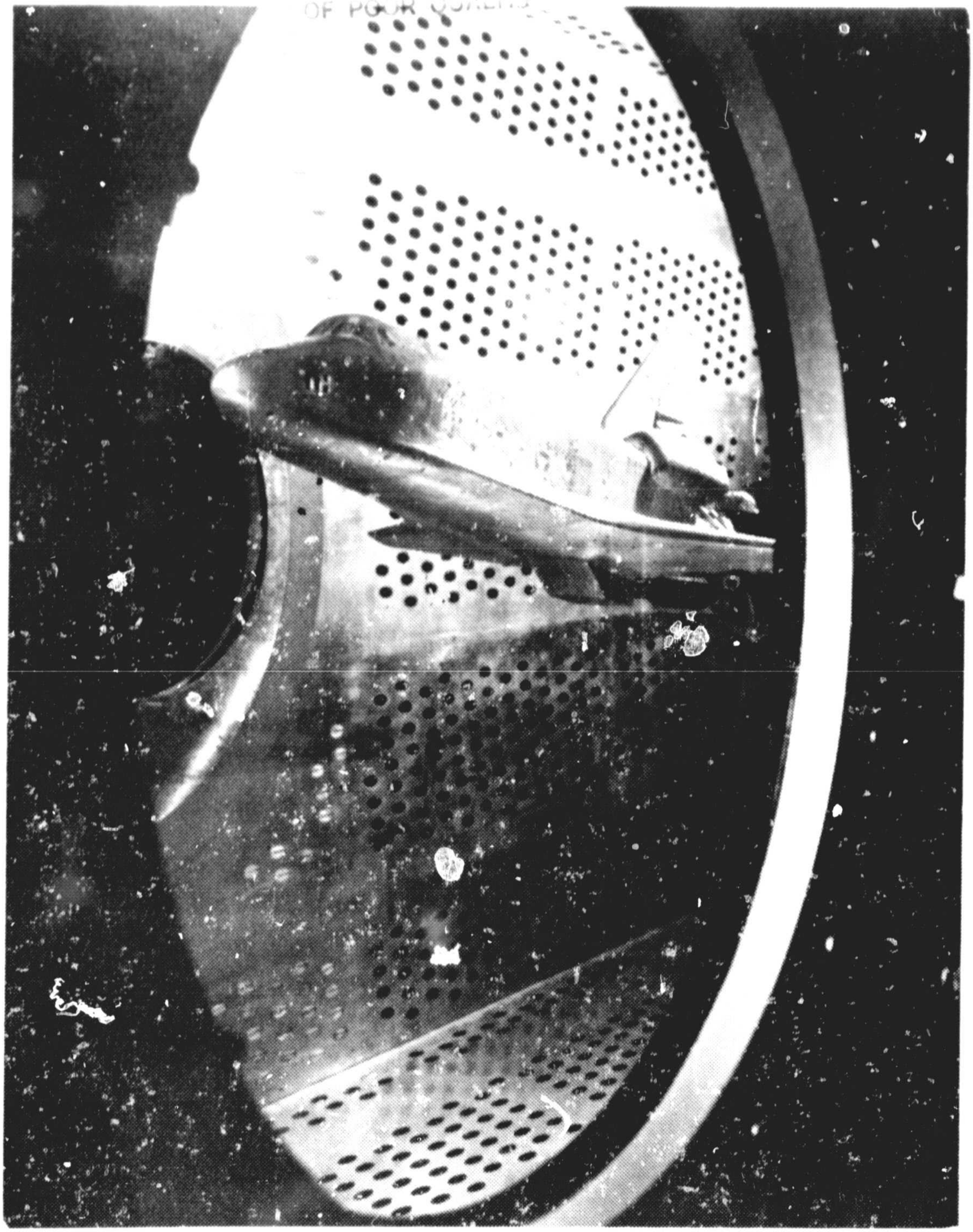


b. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Ames Research Center 11x11 foot Transonit Wind Tunnel

Figure 2 (Cont'd)



c. Installation Photograph of the 0.035 scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 8x6 foot Supersonic Wind Tunnel

Figure 2 (Cont'd)

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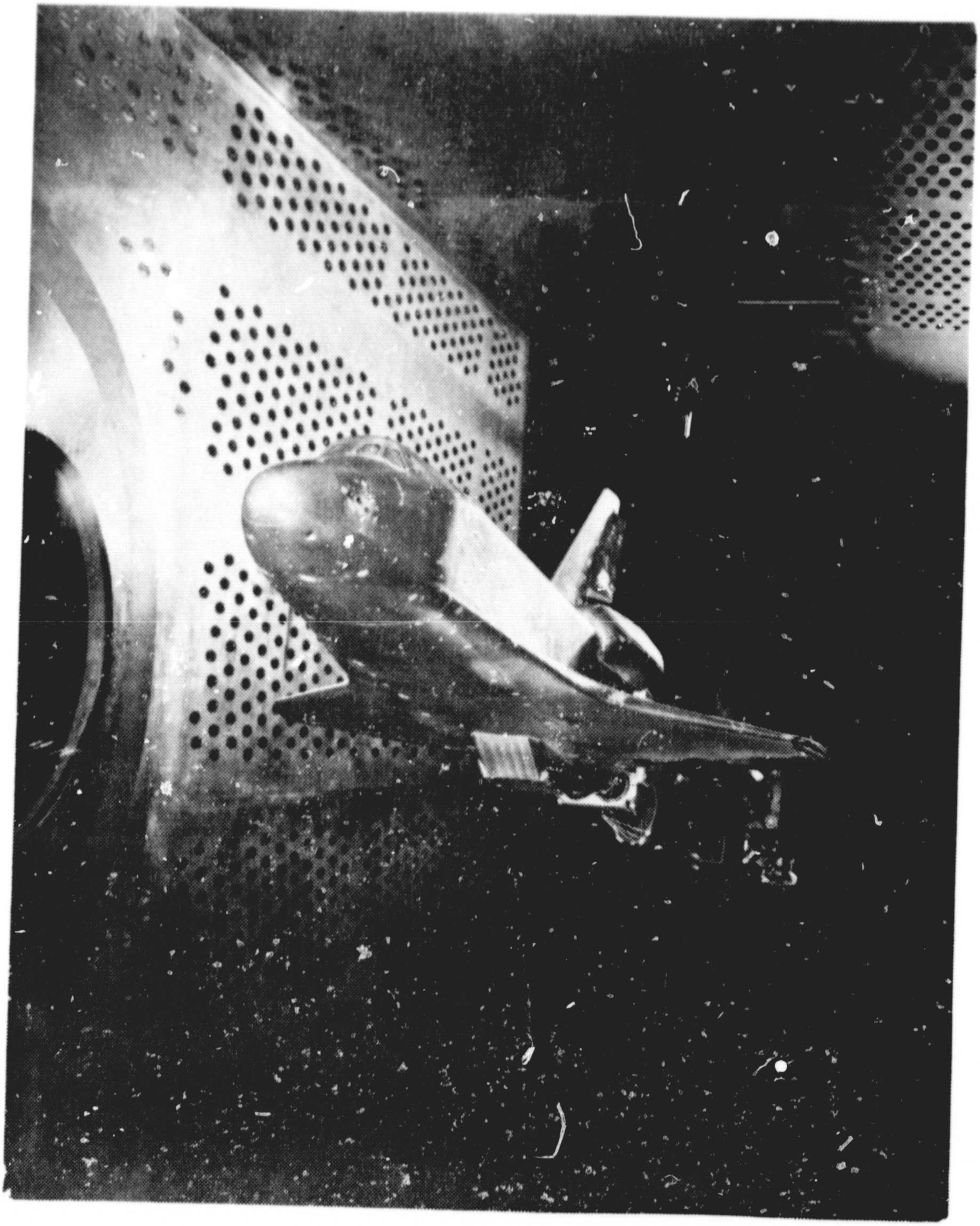
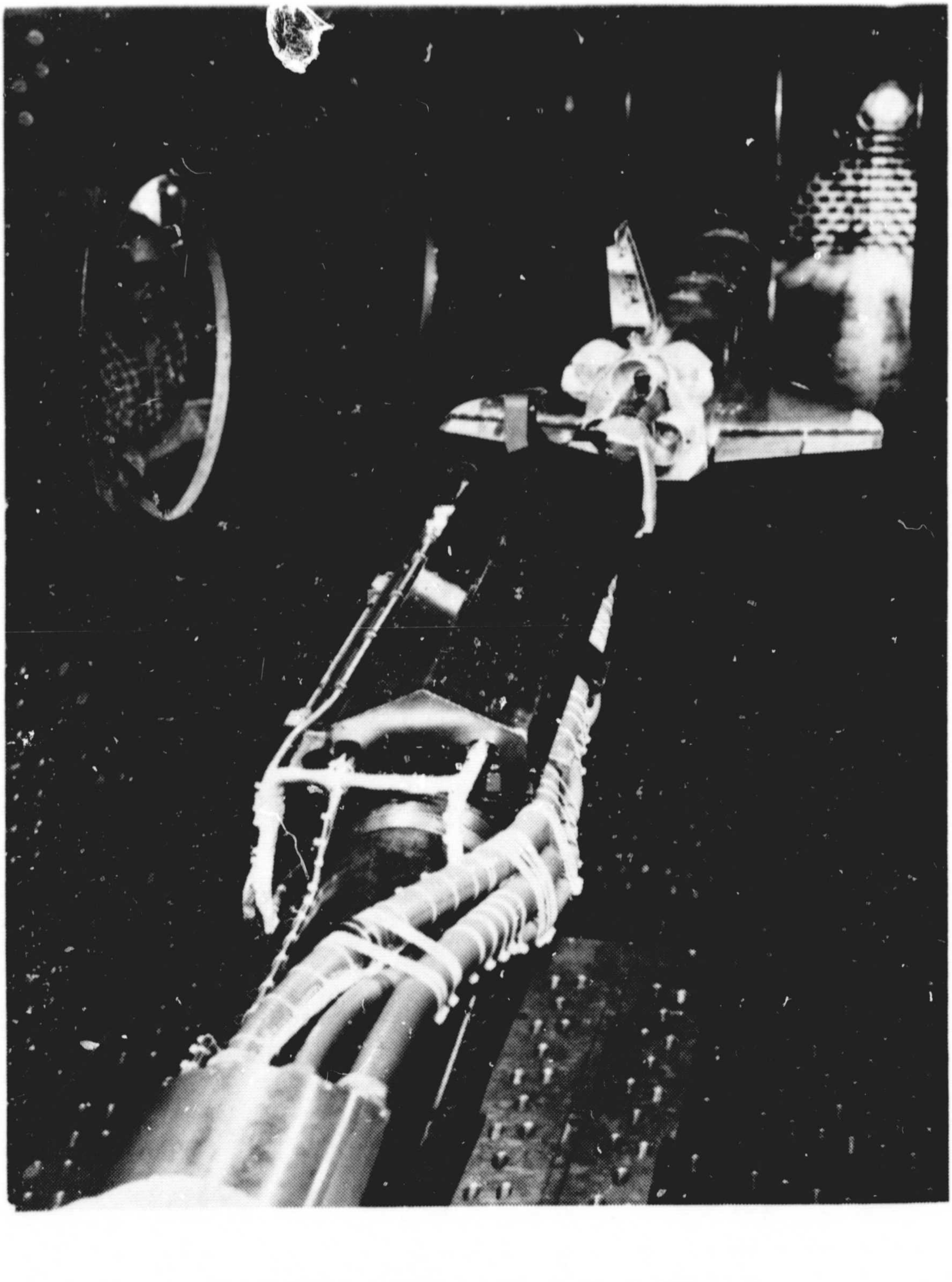


d. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/LEWIS Research Center 8x6 foot Supersonic Wind Tunnel

Figure 2 (Cont'd)

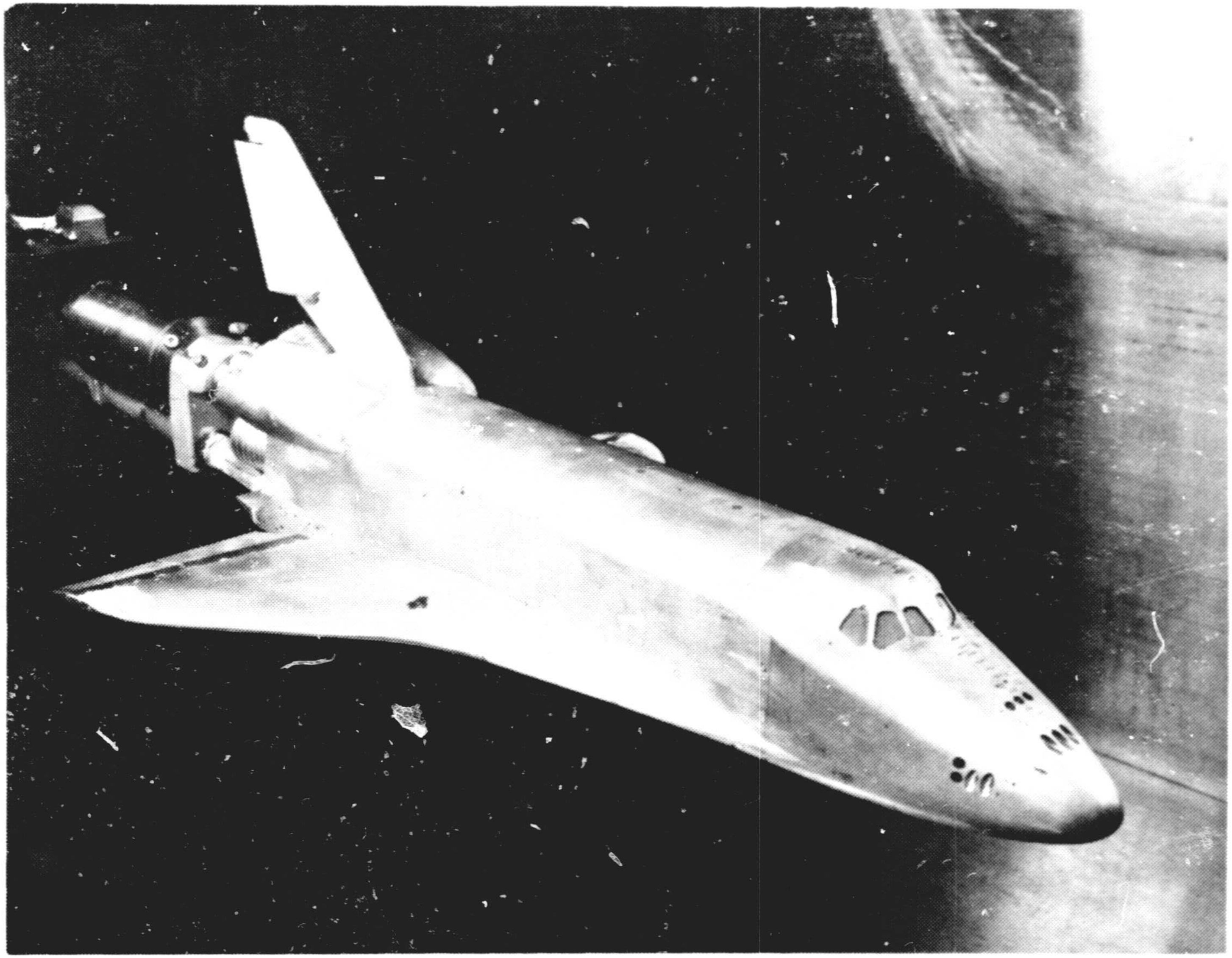


e. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 8x6-foot Supersonic Wind Tunnel

Figure 2 (Cont'd)

f. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 10x10 foot Supersonic Wind Tunnel

Figure 2 (Cont'd)

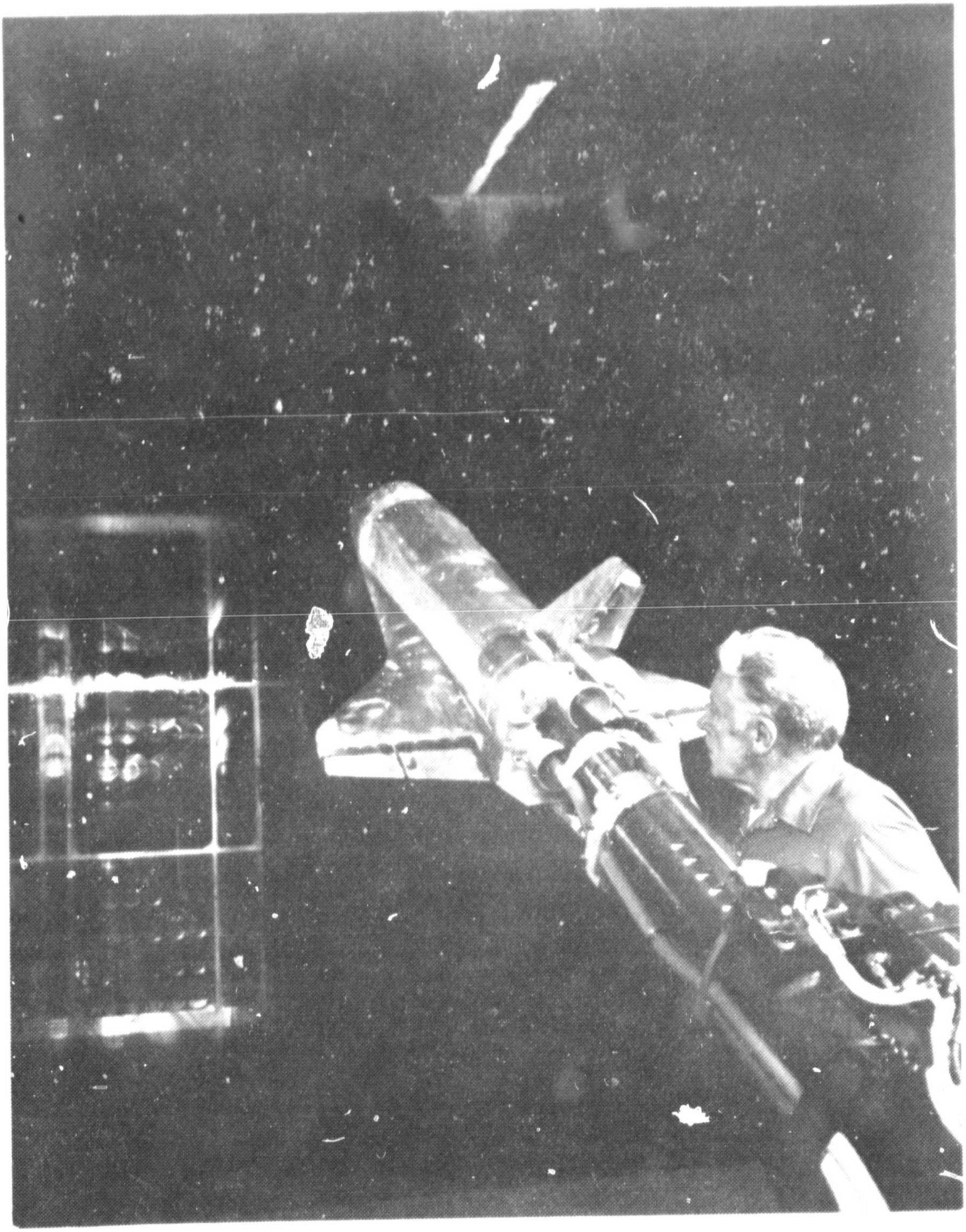


g. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 10x10-foot Supersonic Wind Tunnel

Figure 2 (Cont'd)

h. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 10x10-foot Supersonic Wind Tunnel

Figure 2 (Cont'd)



. Installation Photograph of the 0.035-scale Space Shuttle Vehicle Pressure-Loads Model 84-0 in the NASA/Lewis Research Center 10x10 foot Supersonic Wind Tunnel

Figure 2 (Concl'd)

Appendix

Volume 2

Microfiche only

(See page 32 for component breakdown)